# Connecting proposed regional plans to future hydrologic implications

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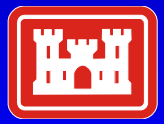
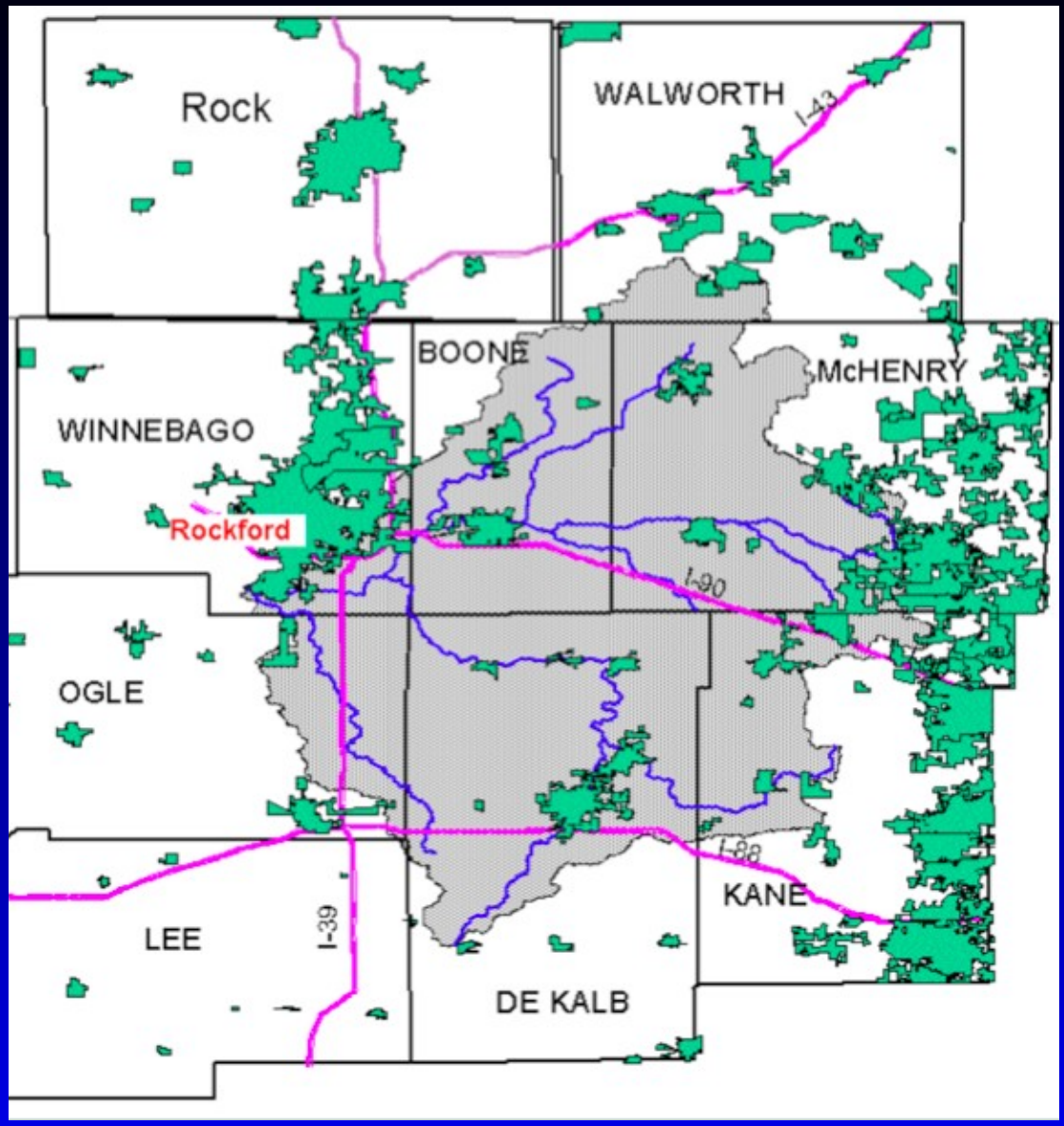


# Problem

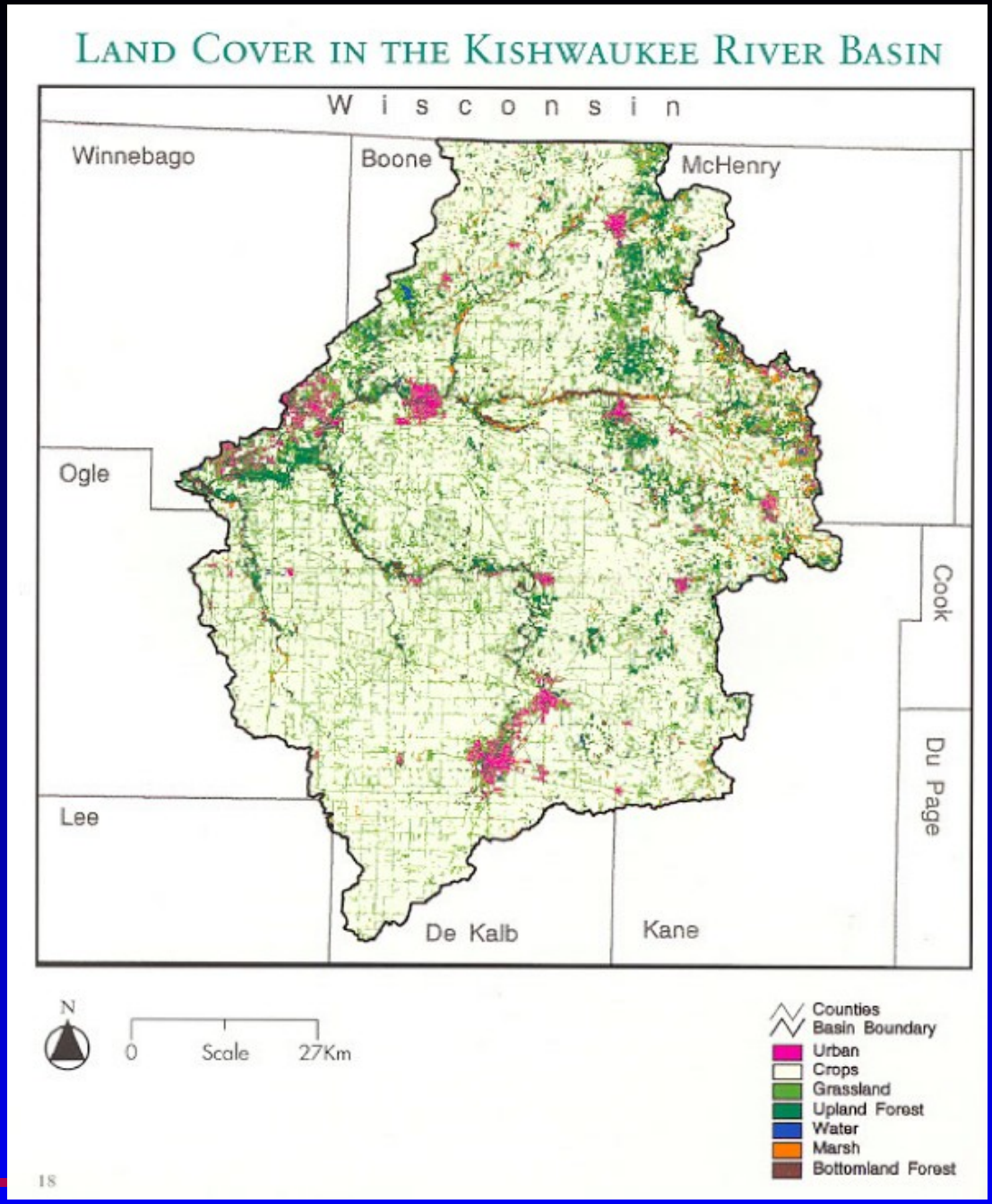
- **Predict future hydrologic implications of proposed regional investments and policies.**

# Case Study

- Part of the Rock River
- Far Chicago urban fringe
- Opportunities for long-term protection of natural lands



# Land Cover


Land Cover in the Kishwaukee River Basin
Wisconsin
Winnebago
Boone
McHenry
Ogle
Cook
Du Page
Lee
De Kalb
Kane
N
0
Scale
27Km
Counties
Basin Boundary
Urban
Crops
Grassland
Upland Forest
Water
Marsh
Bottomland Forest
18

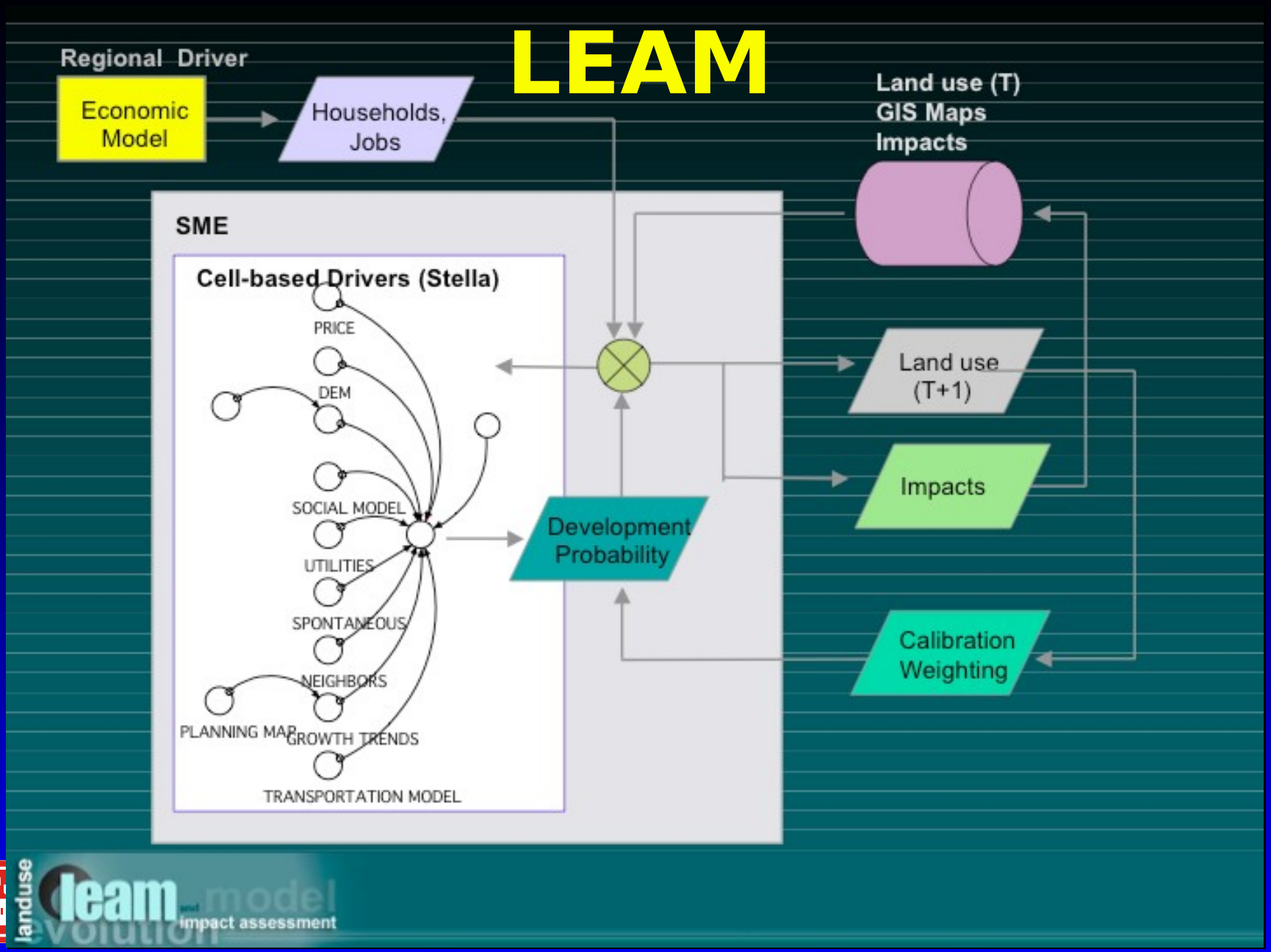
# Tools

- GIS
  - GRASS, ESRI
- GIS Data
- Regional urban development model
  - LEAM
- Raster-based hydrologic simulation model
  - GSSHA

# The Urban Growth Model

- **LEAM**
  **Landuse Evolution and Assessment Model**
  **Raster GIS based - 30m cells**

  - **Purpose**
    - **Forecast future regional urban patterns**
    - **Converts undeveloped land to**
      - **Residential**
      - **Commercial**
      - **Urban open space**
  - **Inputs**
    - **Current land use and land cover**
    - **Roads**
    - **Development policies**


LEAM
Regional Driver
Economic Model
Households, Jobs
Land use (T)
GIS Maps
Impacts
SME
Cell-based Drivers (Stella)
PRICE
DEM
SOCIAL MODEL
UTILITIES
SPONTANEOUS
NEIGHBORS
PLANNING MAP
GROWTH TRENDS
TRANSPORTATION MODEL
Development Probability
Land use (T+1)
Impacts
Calibration Weighting
landuse
leam
impact assessment

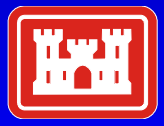
# LEAM

- Developers:
  - University of Illinois
    - Department of Urban and Regional Planning
  - Army Corps ERDC
    - Construction Engineering Research Lab
  - Co-located in Champaign/Urbana, Illinois

# The Hydrologic Model

- **GSSHA**
  **Gridded Surface Subsurface Hydrologic Analysis**
  **Raster, vector GIS based - 90m cells**

  - **Purpose**
    - **Simulate water movement**
      - **Overland, evapotranspiration, groundwater, streams**
  - **Inputs**
    - **Land use, land cover**
    - **DEM**
    - **Stream courses**
    - **Geology, soils**
    - **Storm rainfall**



# Example Output of GSSHA

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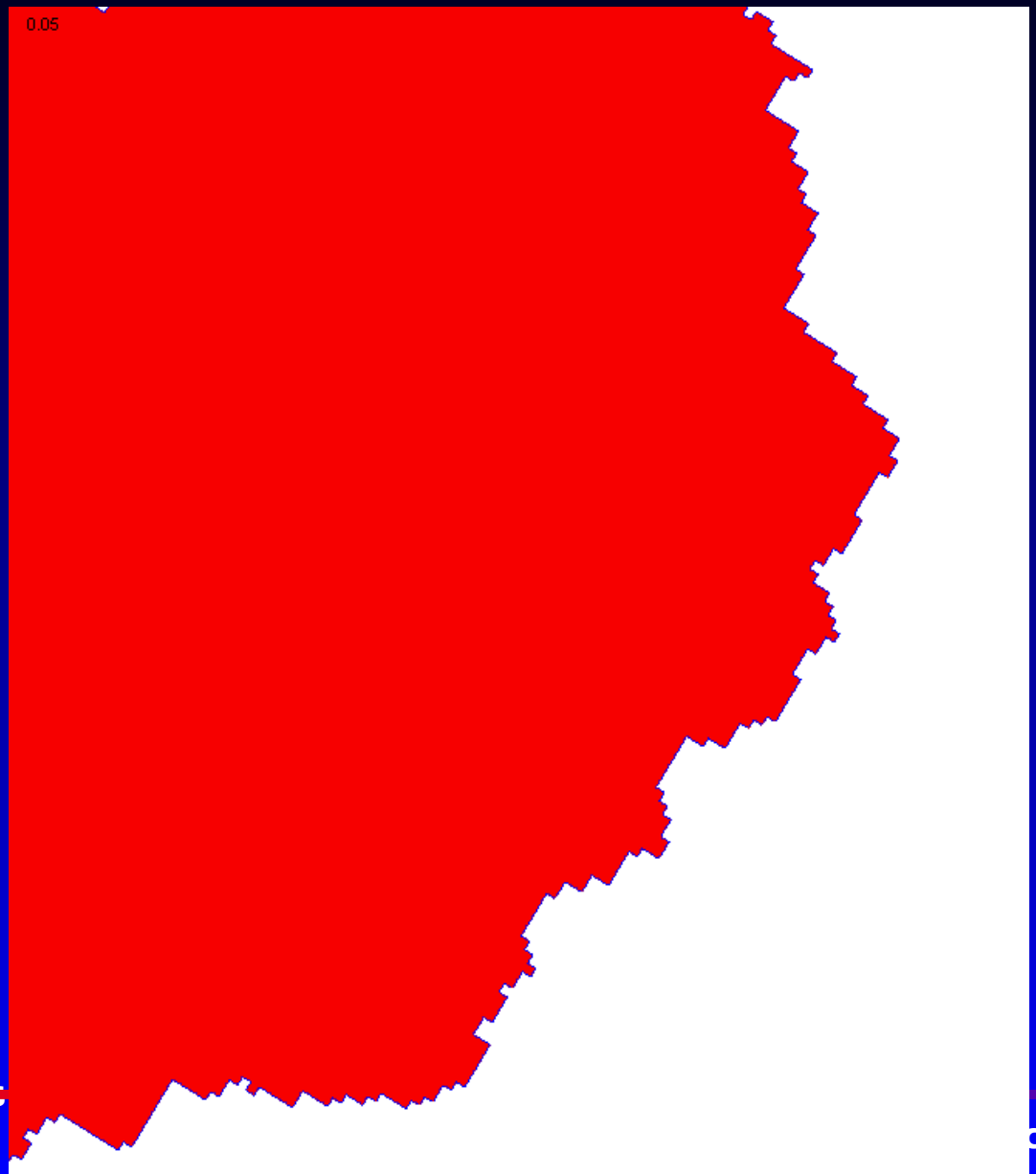
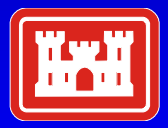


# GSSHA

- **Developers:**
  - **Army Corps ERDC**
    - **Coastal and Hydraulics Laboratory**
    - **Vicksburg, Mississippi (WES)**
- **Availability**
  - **Part of the Watershed Modeling System (WMS)**



# Kishwaukee Watershed Interest Groups

- Farmers
- Long-term residents
- New neighborhoods
- Chicago second-home owners
- Environmental groups
- Pro-growth
- Low-growth

# Regional Planning Opportunities

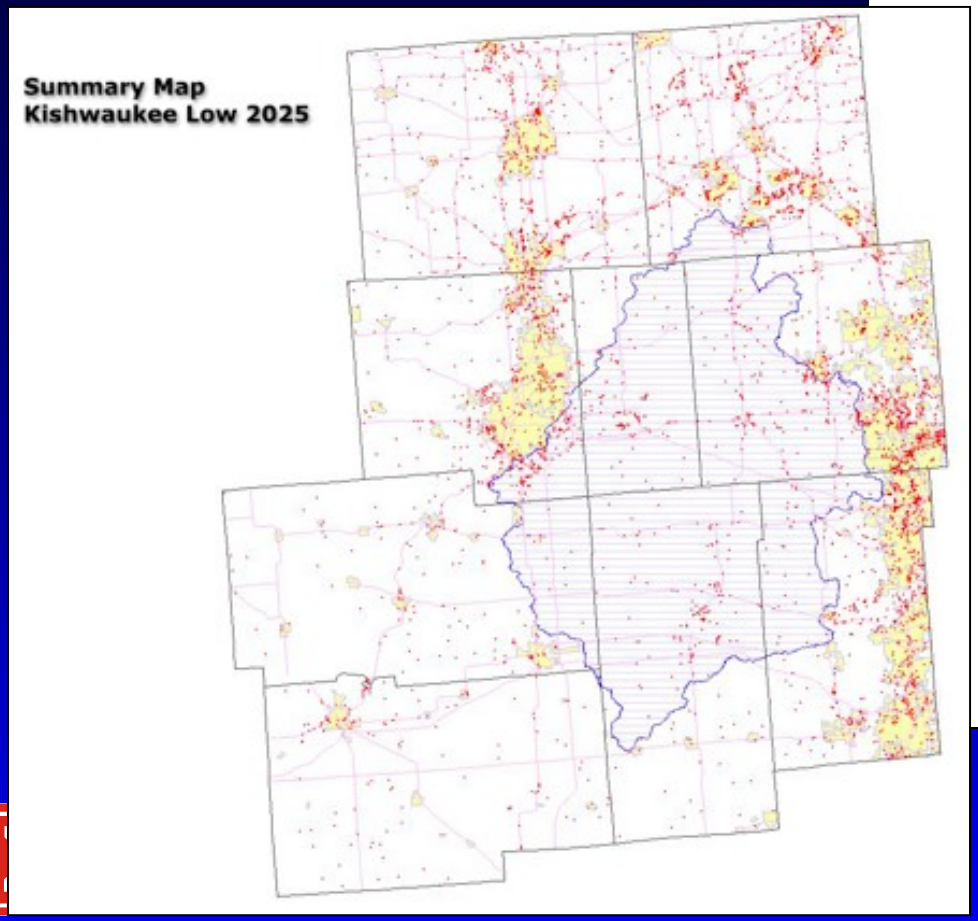
- Support development
- Road access to major centers
- Avoid future costly flooding and flood management
- Preserve wetlands and habitats

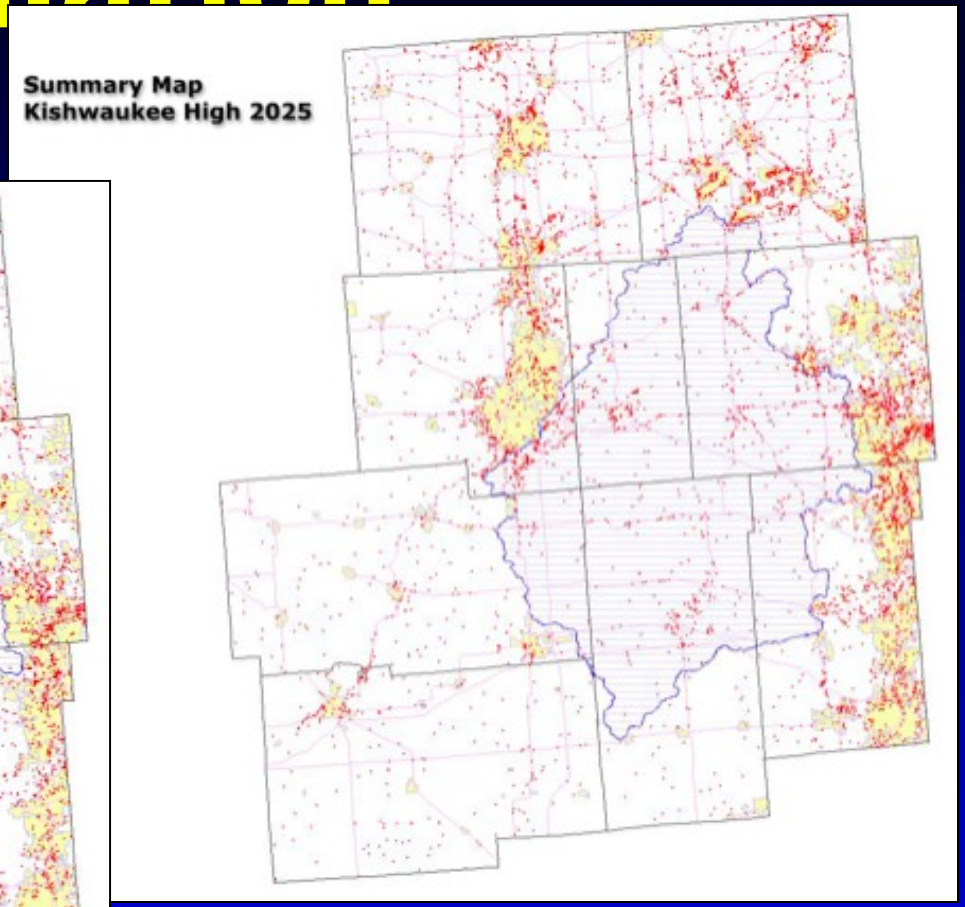
# Attractors to Development

- Distance to cities/jobs
- Distance to nearest road, highway, intersection, interstate on-ramp
- Distance to forest, water
- Slope
- Zoning (e.g. growth/no-growth)
- Nearby existing development

# Urban Growth Simulation

- No-change scenario
- 25 1-yr time steps

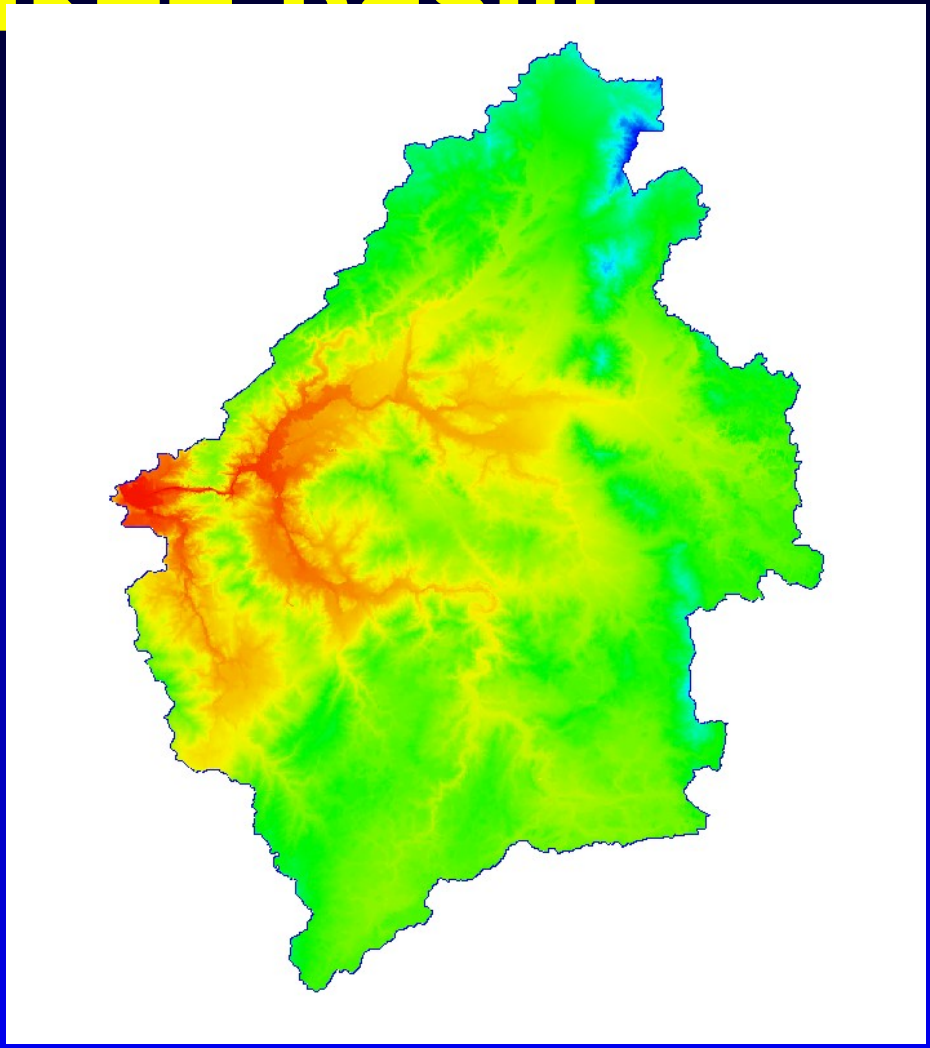



- Yellow - old urban
- Red - new urban

# Inputs for the GSSHA Simulation of the Kishwaukee Basin

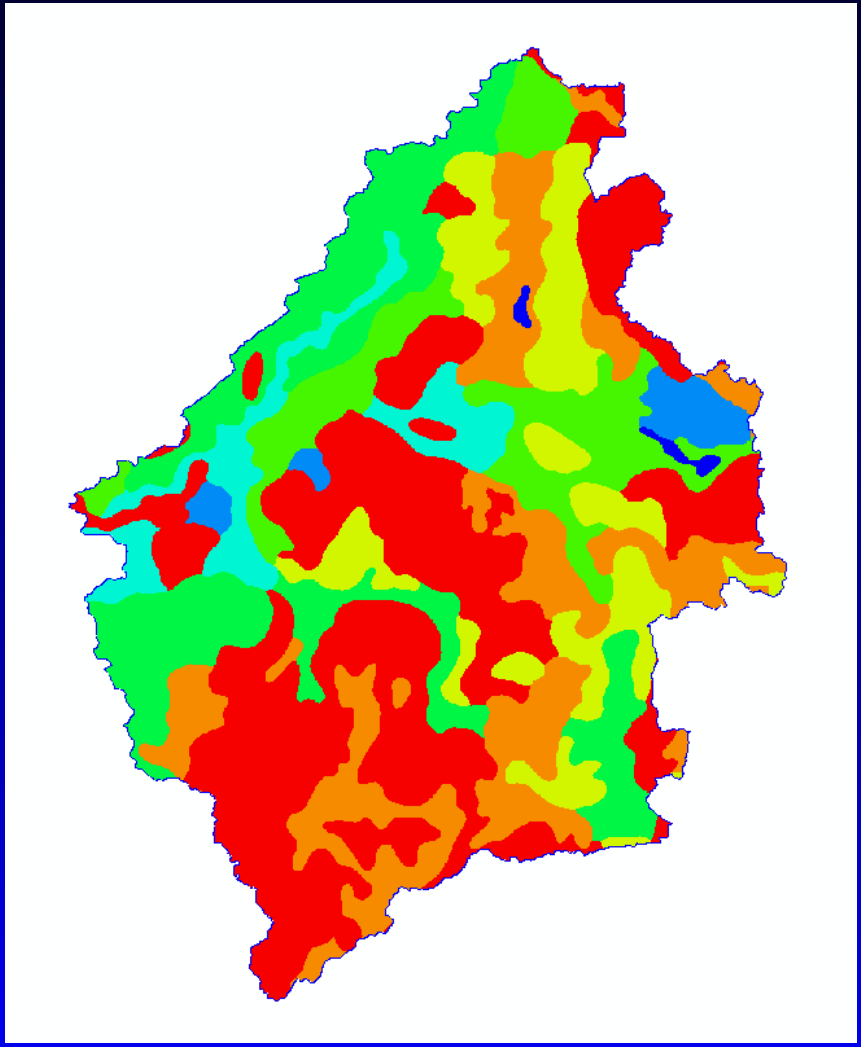
- Digital Elevation Model



# Kishwaukee Simplified Soils

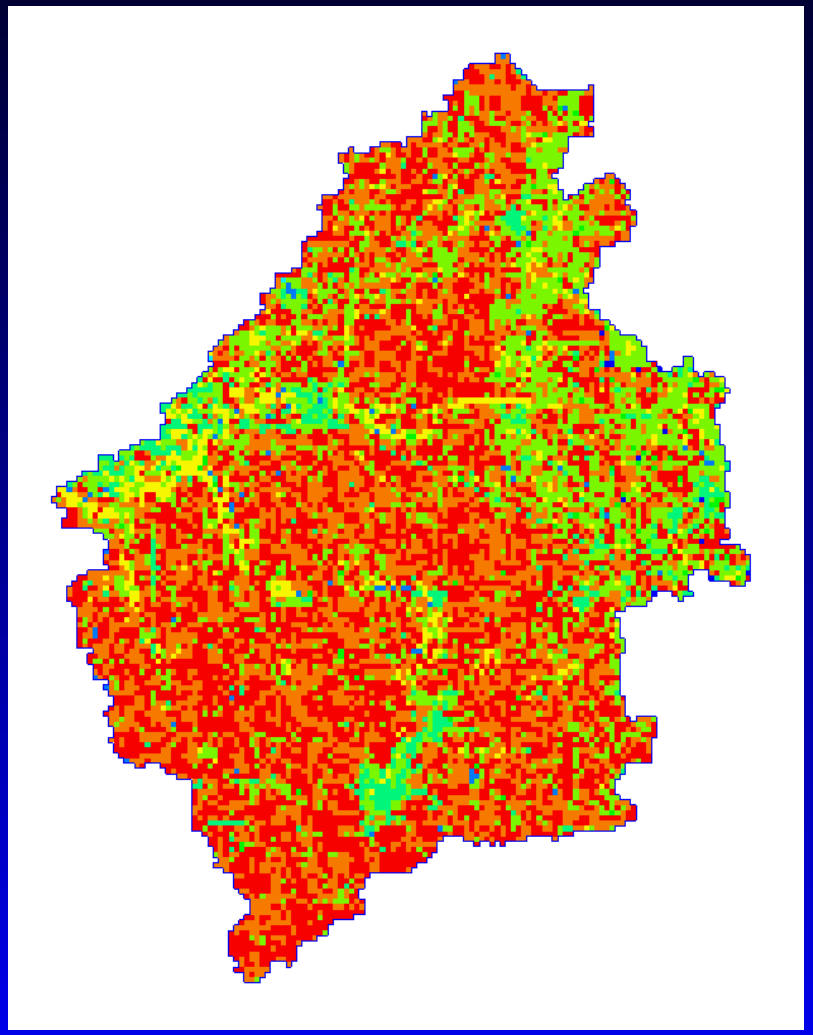
Originally From STATSGO Data

- 8 Soil Types
- 3 Subsurface Layers
- Simplified by similar surface, subsurface characteristics

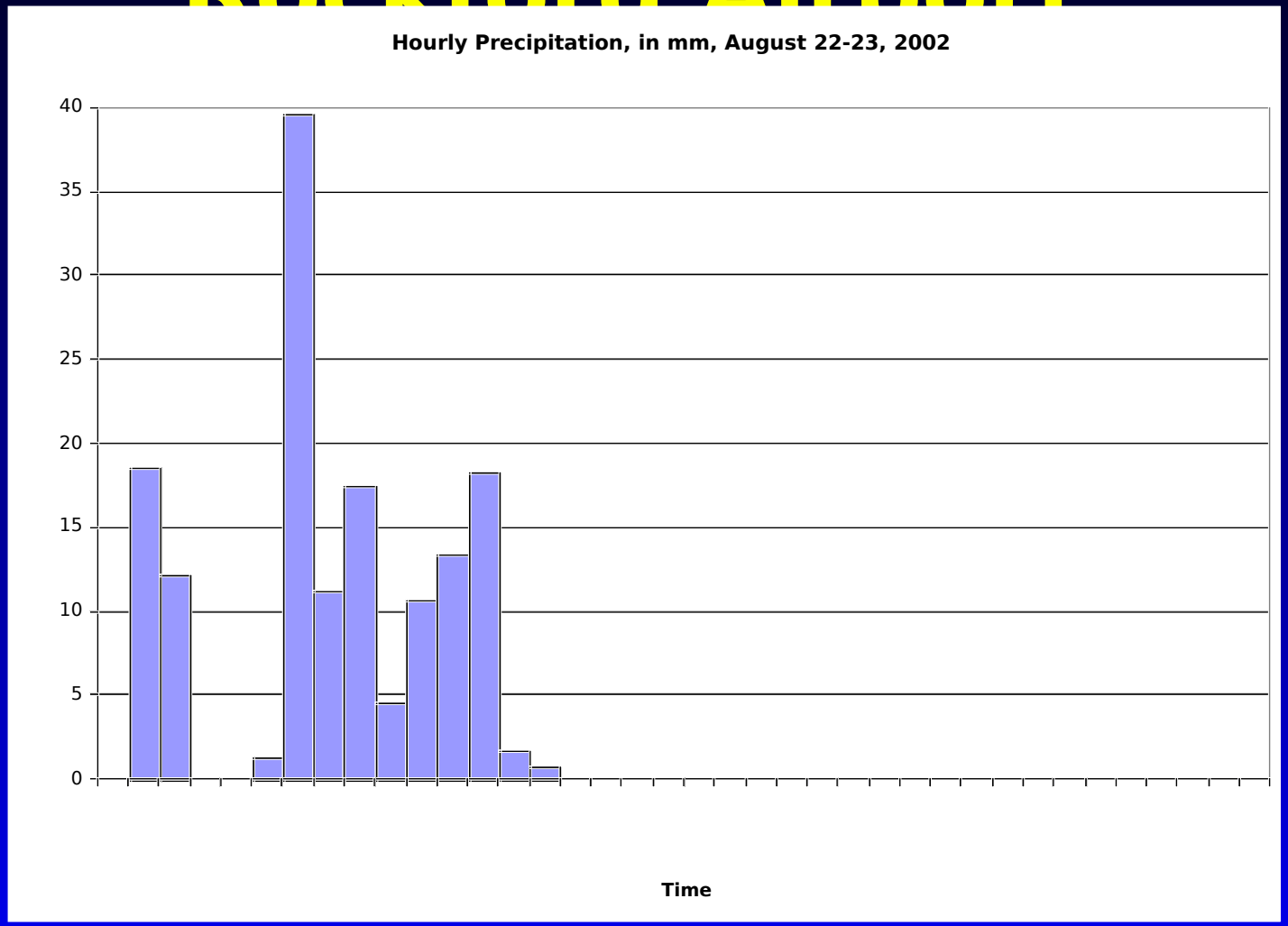


# Kishwaukee Land Cover (1999)

- 6 Classifications
  - Urban
  - Corn
  - Soybeans
  - Forest
  - Wetlands
  - Grassland

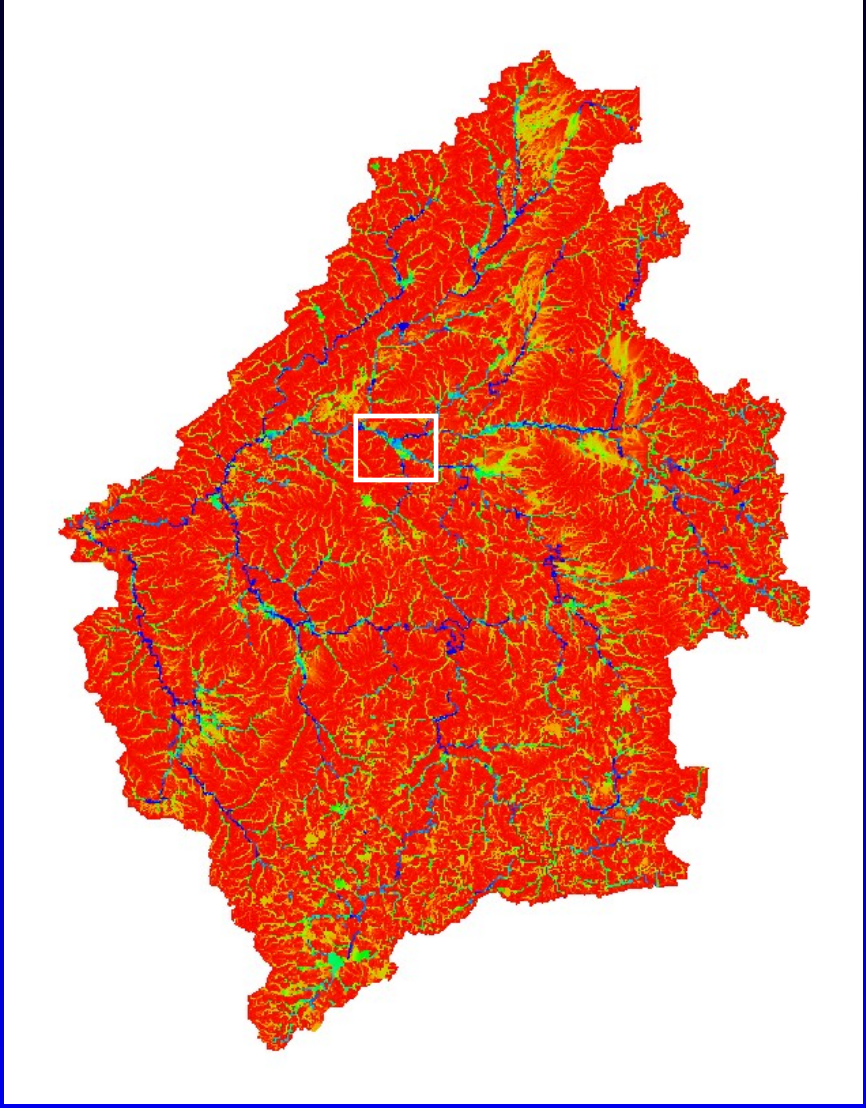


# Precipitation, Aug 22-23, 2002
# Rockford Airport



# Preliminary Results

- Snapshot of water depth
- Rainbow color table with red low
- Hydrograph generated for every grid cell



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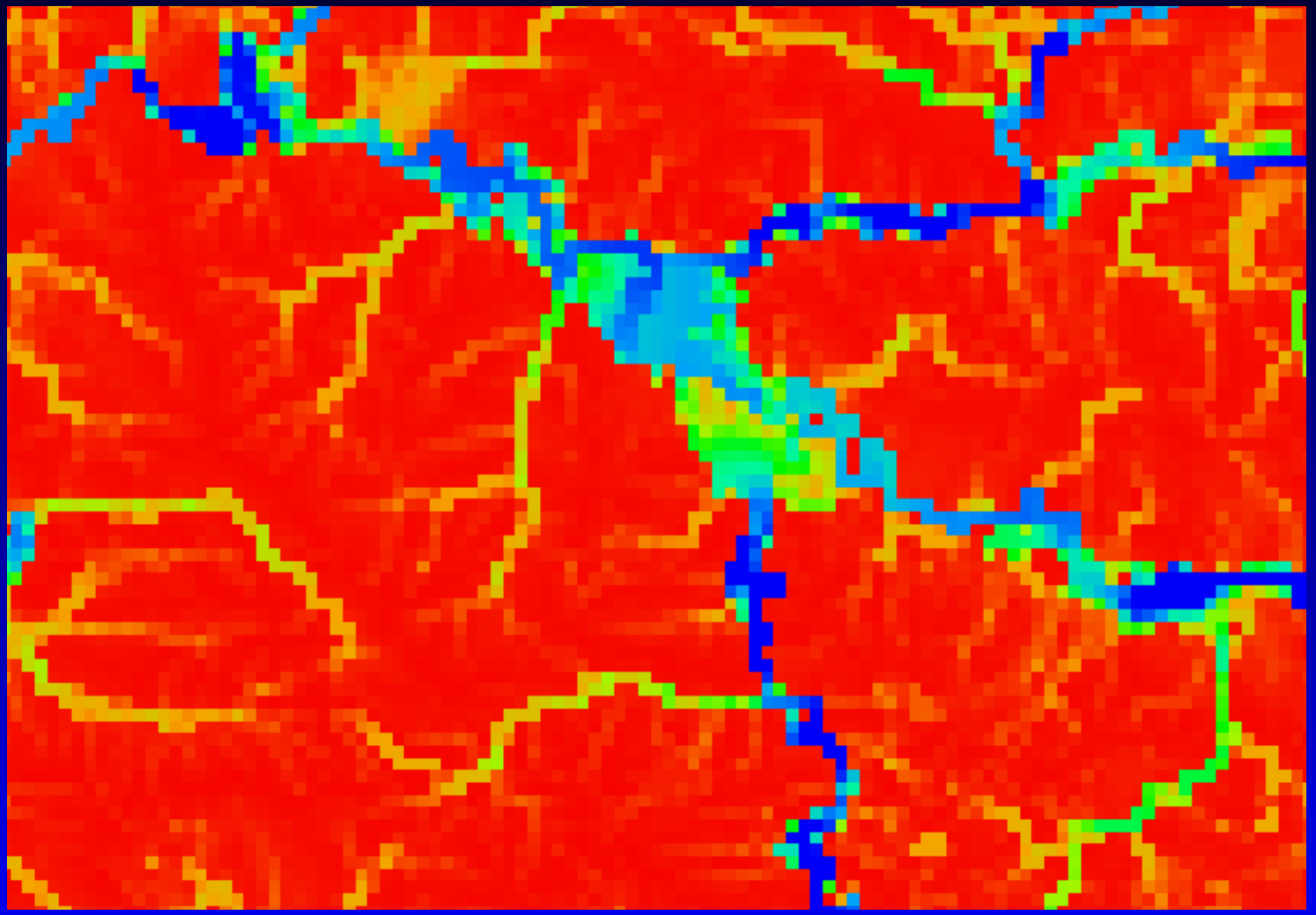
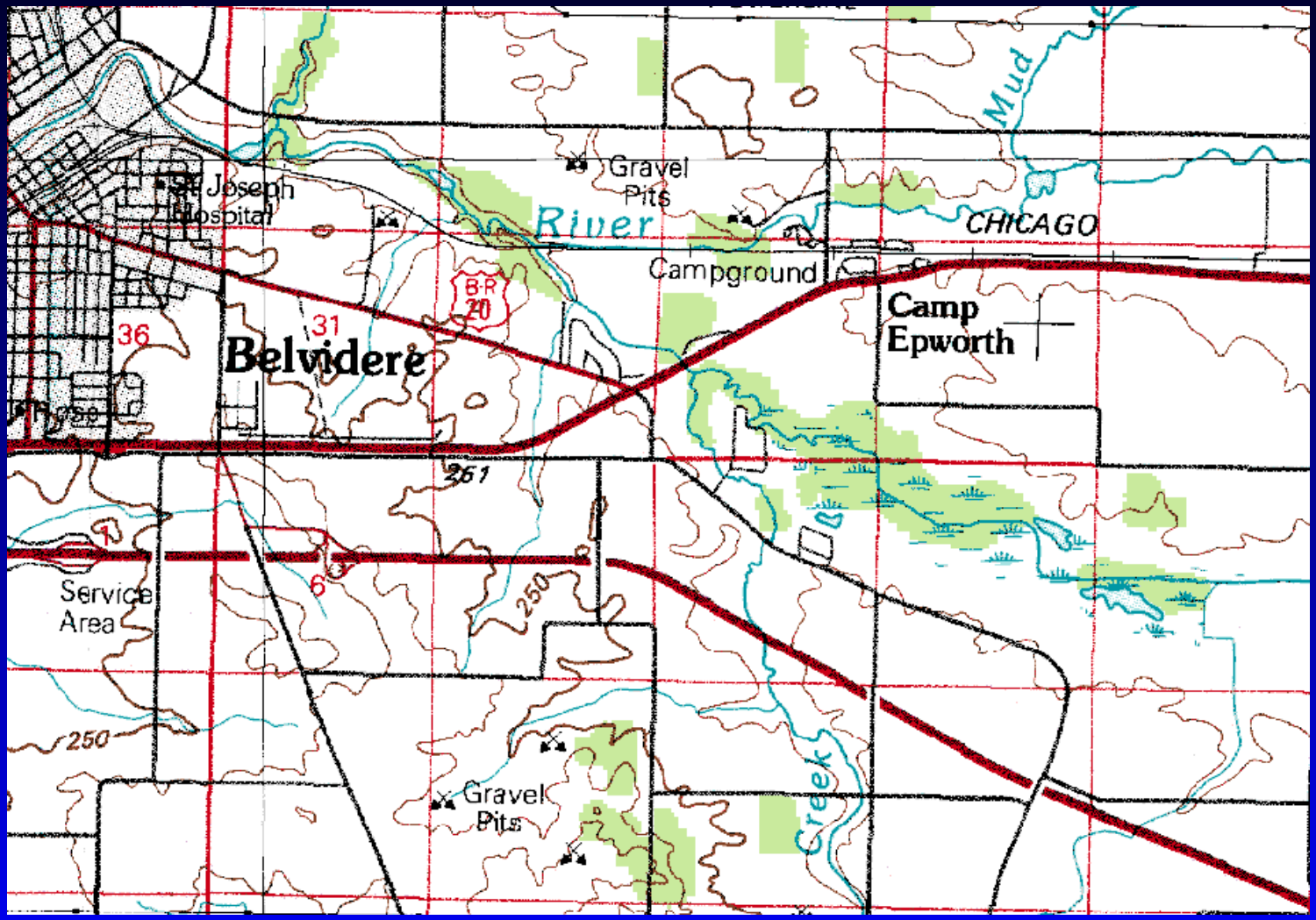
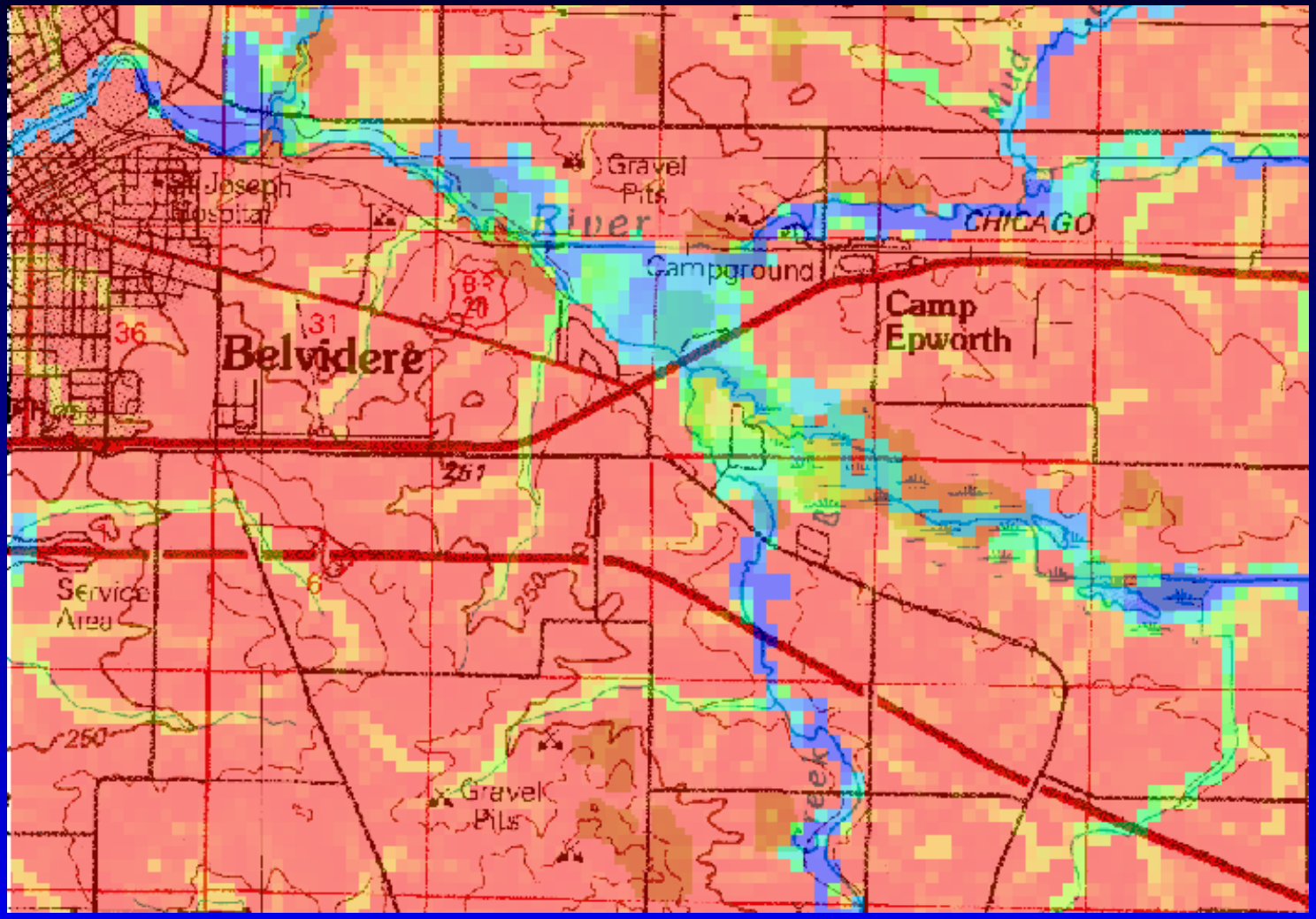


# USGS Quad Sheet



# Results Overlaid on Quad Sheet



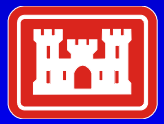
# Progress

- Current
  - Working urban growth and hydrologic models for the area
- Planned
  - Further calibration
  - Scenario testing
- Unfunded
  - Develop a Web interface to allow scenario development and testing

# Take Home

- Simulation modeling is
  - Getting simpler to use
  - Available to work at relatively high resolution

- Integration of gridded urban growth and hydrologic simulation models are useful for testing proposed regional plans on the long-term hydrologic impact



# Further Information

- LEAM
  - http://www.leam.uiuc.edu
- GSSHA
  - http://chl.erdc.usace.army.mil/

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